DOCUMENT RESUME

ED 449 468 CS 014 223

TITLE	The ATOS[TM] Readability Formula for Books and How It Compares to Other Formulas. Report.
INSTITUTION	School Renaissance Inst., Inc., Madison, WI.
PUB DATE	2000-07-00
NOTE	10p.
AVAILABLE FROM	School Renaissance Institute, P.O. Box 45016, Madison, WI 53744-5016. Tel: 800-200-4848 (Toll Free); Fax: 608-664-3882; Web site: http://www.SchoolRenaissance.com.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Comparative Analysis; Elementary Education; *Readability Formulas; *Reading Comprehension; *Reading Material Selection; Reading Research; *Recreational Reading
IDENTIFIERS	Matching Ability; Text Factors; *Trade Books

ABSTRACT

Readability formulas estimate how difficult text is to read. The resulting "readability level" helps teachers and school librarians match students to appropriate books. Guiding students to appropriate-level books is now easier and more accurate with the ATOS (Advantage-TASA Open Standard) Readability Formula for Books, the new readability formula developed by Renaissance Learning, Inc. This report discusses the advantages and disadvantages of popular readability formulas, including a comparison of open and closed standards. The report also discusses some of the limitations of all readability formulas and how best to use readability formulas to help match students and books. Finally, it describes the new readability formula, ATOS for Books, and how it overcomes some of the limitations of older formulas. (Contains 4 tables of data and a 15-item bibliography.) (NKA)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 449 468

The ATOS Readability Formula for Books and How it Compares to Other Formulas.

Report

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
K. Hintz
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

CS 014 223

REPORT from the School Renaissance Institute

July 2000

The ATOS™ Readability Formula for Books and How it Compares to Other Formulas

Introduction

Readability formulas estimate how difficult text is to read. The resulting "readability level" helps teachers and school librarians match students to appropriate books. Matching book readability to students' reading levels helps make students successful and keeps them motivated. It ensures that the books students read are challenging enough to provide useful practice, but not so hard as to be frustrating (Chall, Conard, and Harris-Sharples 1991). This is why School Renaissance Institute, Inc. (formerly the Institute for Academic Excellence, Inc.), as part of its Reading Renaissance training, provides tables that enable teachers to use students' tested grade-equivalent reading levels to estimate their zone of proximal development (ZPD)—the range of challenge in which maximum growth can occur (Vygotsky 1962; School Renaissance Institute 1999). Readability levels also help promote student independence by encouraging self-selection of books, and help teachers, librarians, and parents assist students in choosing books.

Guiding students to appropriate-level books is now much easier and more accurate with the ATOS (Advantage-TASA Open Standard) Readability Formula for Books, the new readability formula developed by Renaissance Learning, Inc. (formerly Advantage Learning Systems, Inc.), makers of Accelerated Reader (AR) reading software, and Touchstone Applied Science Associates, Inc. (TASA). It's important to remember, however, that matching books to students is not a mechanical process. ATOS for Books is a better readability formula, but all readability formulas should be used with caution. It's not just a matter of putting a number on a book, assigning a number to a student, and matching the numbers. Matching students and books is always a two-step process in which readability measurement is a starting point.

This paper discusses the advantages and disadvantages of popular readability formulas, including a comparison of open and closed standards. It also discusses some of the limitations of all readability formulas and how best to use readability formulas to help match students and books. Finally, the paper describes a new readability formula, ATOS for Books, and how it overcomes some of the limitations of older formulas.

Some Common Readability Formulas

The first readability formulas were developed more than 50 years ago. The formulas fell out of favor during the '70s and '80s, but have recently made a comeback. They have returned in part because students are doing more literature-based reading. The prevalence of Accelerated Reader computerized reading management software also helps account for the resurgence of interest in readability formulas. Accelerated Reader has incorporated readability formulas for more than 14 years.

In the past, five different readability formulas have been used frequently by educators. Each of the five can have slight advantages and disadvantages, depending on how they are used. Dale-Chall, Flesch-Kincaid, and Fry are on a grade-level scale while Degrees of Reading Power (DRP) and Lexile have their own unique scales. Most teachers and librarians prefer grade-level scales because they are easy to understand and use in communicating with students and parents.

All five formulas base their calculations on two variables: (1) semantic difficulty as measured by word length, word familiarity, or word frequency, and (2) syntactic difficulty as measured by sentence length—the average number of words per sentence. As a result, the formulas tend to

measure similar factors, correlate well with one another, and, on average, yield only slight differences.

One way in which readability formulas differ is whether they are open or closed standards. Most often teachers and suppliers of reading materials to schools use "open standards"—formulas that can be applied to any material and for which they do not pay a fee. This leaves teachers and school districts free to use whatever materials they want, depending on their preferences and needs. Teachers have the flexibility to use one readability formula for textbooks and another for literature-based reading. In addition, systems such as the School Renaissance Institute's ZPD tables, which express book readability on a grade-level scale, allow teachers to use their students' grade-equivalent scores from *any* nationally normed reading test to place students in appropriate books. Examples of open standards include Dale-Chall, Flesch-Kincaid, Fry, and ATOS.

Conversely, a "closed standard"—one formula applied to all materials and for all purposes—limits flexibility and may cost districts more. The Lexile Framework is a closed standard. If a district were to adopt the Lexile Framework for measuring readability, teachers and librarians could be forced to use only those reading materials that report readability levels according to the Lexile formula—materials sold by trade book and textbook publishers who can afford the Lexile fees. The arrangement would limit the choices in reading materials available to teachers and students. In addition, in order to match students to appropriate books, students need to take a Lexile approved or licensed test.

More information on the similarities and differences of the popular formulas is given below:

Dale-Chall Readability Formula (grade-level scale). Edgar Dale and Jeanne S. Chall first published their readability formula in 1948 (Chall and Dale 1995; Chall et al. 1996). It was based on the Dale list of 3,000 words familiar to fourth-grade students. A new Dale-Chall readability formula and revised Dale word list were published in 1983. In addition to the percentage of words found on the Dale list, the formula uses average number of words per sentence.

Degrees of Reading Power Values (DRP) (1-100 scale). TASA developed the DRP scale for measuring reading ability and text difficulty in the late 1970s (Koslin, Zeno, and Koslin 1987; Zeno et al. 1995). A readability formula developed by Bormuth in 1969 is the basis for calculating the text difficulty measure (Bormuth 1969, 1971). The Bormuth formula relies on two factors used in the original Dale-Chall formula (percentage of words on the Dale word list and average number of words per sentence) and adds a third factor: word length.

Flesch-Kincaid Formula (grade-level scale). Rudolph Flesch developed the Flesch Reading Ease Index in the 1940s (Flesch 1948). The Flesch-Kincaid formula is a variation on this original formula and was developed by J. Peter Kincaid in the mid-1970s (Kincaid 1975). Two variables are used: average syllables per word and average words per sentence. Maximum Flesch-Kincaid scores are now stipulated for Department of Defense contracts and some Internal Revenue Service and Social Security Administration documents. This formula also has been incorporated into most word processing programs and has been adopted for insurance policies and documents used in health care and other industries. The wide acceptance of the Flesch-Kincaid formula, along with its ease of use and accuracy, led Renaissance Learning to start using it in Accelerated Reader in 1993.

Fry Index (grade-level scale). Edward Fry developed the Fry Index in 1968. It is the easiest formula to use without electronic implementation, and is still widely used for this reason. Three 100-word passages are selected from a text. To determine readability, the user looks up on a chart the average number of syllables and sentences in these passages (Fry 1968). Since the Fry and Flesch-Kincaid formulas use the same variables, they yield similar results.

Lexile Framework (0-2000 scale). The founders of MetaMetrics, Inc., developed the Lexile Framework in the mid-1980s through grants from the National Institute of Child Health and Human Development (Stenner, 1996). This formula is based on average word frequency found in the *American Heritage Intermediate Corpus* (by Carroll, Davies, and Richman 1971) and the average number of words per sentence. Average word frequency is not as good a predictor of semantic difficulty as either word length or word grade level (see table below). Therefore, Lexile is likely to be less accurate than most other formulas. The AHI corpus includes words from 1,045 published titles to which students in grades three through nine were commonly exposed at the time the corpus was developed. The titles heavily favored textbooks rather than trade books and the corpus is now relatively old. In addition, the Lexile Framework is a *closed* standard, meaning one must use a Lexile reading test or Lexile licensed test to match a student to a book. Other standardized norm-referenced tests cannot be used. Although MetaMetrics claims to be the only system that puts reader and text on the same scale, School Renaissance Institute has for years published ZPD tables that put reader and text on the same scale. Also, the School Renaissance Institute system is an *open* system, meaning that any standardized

norm-referenced reading test can be used, unlike Lexile which requires a MetaMetrics licensed test.

Limitations of Readability Formulas

As shown in the descriptions above, each of the formulas use very similar measurements of semantic and syntactic difficulty—which explains why most formulas yield similar results on average. However, there can be a high degree of variance in published readability measurements for a particular book. The reason for these differences and the reason why any readability formula must be used with care is that both reading tests and readability formulas are subject to error. Reading test results contain "sampling error"—the variability that results from trying to estimate the whole of something by measuring only a part of it. Reading tests try to measure a student's entire reading ability from an hour or less of measurement, thus producing sampling error. For groups, such as a class, the individual errors tend to cancel out. However, for an individual student, the "standard error" of a test score is normally the score plus or minus about a year.

Sampling error also affects measurements of text readability. Before the relatively recent availability of high-speed text scanners, it was impossible to analyze entire books, so readability analyses were always done using samples of text. Since books can vary widely in reading level from section to section, the error introduced by text sampling can be significant.

All of the older readability formulas described above use only samples of text to level books. Dale-Chall recommends taking one 100-word sample for each 50 pages. Fry uses three 100-word samples regardless of the text length. The standard procedure for determining a Lexile value is to sample 20 pages randomly (Stenner and Burdick, 1997), although any sampling technique up to full text has been used. For DRP values, there is a consistent sampling plan requiring between three and fifteen 300-word samples depending on the length of the book. The Flesch-Kincaid formula may be used on any length text. ATOS eliminates sampling error because all books are leveled based on a computerized full-text scan of the book.

Sampling error also results from the fact that no readability formula can really measure everything that contributes to how readable a book is for a student, any more than any reading test can really measure the whole spectrum of a student's reading behavior. Readability formulas can't measure context, prior knowledge, interest level, difficulty of concepts, or even coherency of text. For example, look at the following two passages:

Four score and seven years ago our fathers brought forth upon this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation or any nation so conceived and so dedicated can long endure.

Endure long can dedicated so and conceived so nation any or nation that whether testing, war civil great a in engaged are we now. Equal created are men all that proposition the to dedicated and liberty in conceived, nation new a continent this upon forth brought fathers our ago years seven and score four.

Obviously, the first passage is the first two sentences of Lincoln's "Gettysburg Address." The second passage is the same text backward. All readability formulas would rate these two passages exactly equal, even though the second is gibberish. The simple truth is that no readability formula is highly accurate in measuring the readability of text—they all provide first estimates for a trained educator who knows her student.

This is why we say that matching books to students is a two-step process. The first step is the initial estimate of ZPD, using the readability measurement, the student's test scores, and the School Renaissance Institute's ZPD tables. The second and most important step is continuous adjustment. The teacher observes her students' reading of actual books, and monitors their performance on Accelerated Reader Reading Practice quizzes. Students should average between 85% and 92% correct. If a student's average regularly falls below this percentage, it's generally because the books he is reading are too hard; if it rises above, the books are too easy. In either case, the teacher needs to make an adjustment in the level of books the student is reading. Daily monitoring of reading behavior through Status of the Class, and setting goals for each grading period, is very helpful. A daily stream of feedback about students' reading practice gives the teacher more reliable information about reading ability than any test could.

The Advantage/TASA Project to Develop ATOS

Matching students to books is a two-step process in which the second step, continuous adjustment, is the most important. However, teachers must still make an initial estimate of ZPD and readability formulas are an important tool for making this estimate. Renaissance Learning felt that teachers and students could benefit from a better tool for estimating readability and in 1998 embarked on a research and development project that ultimately produced the ATOS formula. The goals of the

project were to improve the reliability and accuracy of readability estimates, and to develop a formula specifically designed for matching students to books. To achieve that goal, it was necessary, among other things, for the formula to deal with evaluating fiction versus nonfiction, books for emergent readers, and high interest/low-level books for older readers, all of which have posed problems for readability formulas. It was also Renaissance Learning's goal to create an "open" formula—one which would be available to the educational community free of charge, in a format that would be easy to use, and one which could be used with any nationally normed reading test. The resulting project was perhaps the largest and most comprehensive study of readability ever conducted. Participating with Renaissance Learning were several outside readability experts, including staff from TASA, known for its highly-respected Degrees of Reading Power test and readability scale. This partnership combined the resources of the two leading organizations using readability formulas.

Conducting the study required the creation of new tools, which Renaissance Learning and TASA were uniquely equipped to develop:

- The largest set of reading-test items ever used—more than 650 leveled items from a combination of Renaissance Learning's STAR Reading (norm-referenced computerized reading test) and TASA's DRP norm-referenced test.
- The world's largest word-frequency corpus—474 million words representing all the text of 28,000 K–12 books in the Renaissance Learning quiz library. These are authentic books read by real students. Many were published in the last five years, a fact that makes this corpus more relevant than some used in other readability research that date back several decades and include materials other than K–12 trade books.
- Improved and expanded graded-vocabulary list—starting with TASA's existing list showing which words are most often found in books of different grade levels, and expanding the list based on study of the Renaissance Learning corpus.
- The National Reading Practice database from Renaissance Learning—contains Accelerated Reader records of more than 30,000 students who read and tested on 950,000 actual literature books. Thus, for the first time, substantial data on actual student book reading was incorporated into the design of a readability formula.

The project resulted in three different formulas, each of which will be used for different purposes:

1. **ATOS Readability Formula for Books**—a grade-level scale for measuring book levels. This will be used to establish levels for books used with Accelerated Reader, and will be made available free to publishers and others wanting an improved readability measure for books.
2. **ATOS Readability Formula for Text**—also a grade-level scale, for use with passages such as reading tests.
3. **ATOS Readability Formula for Books, Non-grade-level scales**—formulas that convert the ATOS grade-level scale to 100 point and 2000 point scales similar to those used by DRP and Lexile respectively.

Development of ATOS for Books

The first step in making ATOS the most accurate formula was to analyze variables used in readability research as indicators of text difficulty. All readability formulas measure "semantic" and "syntactic" difficulty (difficulty of words and difficulty of sentence structure). Using data from student testing on DRP test items, the research team arrived at the following correlation statistics to help determine which variables to use in ATOS:

Correlation of Semantic and Syntactic Variables to Text Difficulty

Variables	Correlation (r2)
*Words per sentence	.897
*Average grade level of words	.891
Percent of familiar words	.867
Syllables per word	.839
*Characters per word	.839
Word frequency	.769

*Variables used in ATOS

In the chart above, the "r2" numbers indicate how much of the variation in text difficulty was explained by each variable individually. The higher the r2, the better the variable predicted the difficulty experienced by students. It is interesting to note that average grade level proved to be a substantially better predictor of semantic difficulty than word frequency. Word frequency—the semantic-difficulty statistic used by the Lexile formula—proved a comparatively poor measure of difficulty. The explanation appears to be that many words are common at a certain age or grade level, but then become uncommon—such as "kitten." But in cases like these, infrequency at higher grade levels does not

make them difficult words. In addition, raw word frequencies are not corrected for derivations such as plurals and past tenses but the graded-vocabulary list mentioned above includes close derivatives of words. This newly expanded graded-vocabulary list proved a vital part of making ATOS a better formula.

After examining the relationship between individual variables and text difficulty, many combinations of variables were also examined. The simplest combination of variables that did the best job accounting for variation in text difficulty were the three starred variables above: words per sentence, average grade level of words, and characters per word. These variables form the ATOS Readability Formula for Text.

ATOS Readability Formula for Text, like other readability formulas, was developed using test-item data. However, there are major differences between the experiences of reading books and reading test items. Based on real data of actual book reading experiences, adjustments were made to ATOS for Text, resulting in ATOS for Books, the most accurate formula for *book* leveling.

A key difference between books and tests is that books are much more variable in terms of sentence length, a common measure of difficulty. The ATOS team found that other formulas tend to overstate the difficulty of books with high variability in sentence length. ATOS for Books "dampens" the effect of this factor beyond a certain point.

The team discovered another important variable not previously used in readability formulas: book length. Statistics from the National Reading Practice database indicate that longer books are generally more difficult to read than shorter books. Teachers have always intuitively known this to be true, and have taken length into consideration when recommending books to students. Now there is scientific validation that length is an important factor, and ATOS for Books takes it into account in its calculation of readability.

Data from the National Reading Practice database also allowed the team to further refine ATOS for Books by examining how well the formula predicts readability of fiction versus nonfiction, and high-low books, compared to the previous Flesch-Kincaid Accelerated Reader book levels. In the case of nonfiction, it was found that Flesch-Kincaid tends to understate the difficulty of nonfiction—possibly because nonfiction often contains specialized vocabulary, which is not properly analyzed by just looking at word length. However, using ATOS, the levels of nonfiction books, on average, increase compared to fiction. That is, if a fiction and nonfiction book had similar reading levels using Flesch-Kincaid, the nonfiction book is now about .4 grade levels harder than the fiction book. In the case of high-low books, taking their generally shorter book length into account results in ATOS levels slightly lower than the Flesch-Kincaid levels.

Books written for emergent readers have always presented a problem for readability formulas, typically by understating difficulty. The ATOS team used the Reading Recovery scale to identify key variables for leveling such books and determined how ATOS levels correlate with Reading Recovery levels. The result, as shown in the chart below, is that ATOS is the first readability formula to provide a guideline for teachers to convert between Reading Recovery measurements and grade-level measurements. However, it should be noted that Reading Recovery levels contain a large subjective element so conversions between Reading Recovery levels and more objective measures such as ATOS produce only estimates. The chart below is intended only as a guideline.

ATOS to Reading Recovery Conversion Chart

ATOS Grade Level	Reading Recovery Book Level
.3–.4	1–2
.5–.6	3–5
.7–.9	6–9
1.0–1.2	10–11
1.3–1.5	12–13
1.6–1.9	14–15
2.0–2.4	16–17
2.5	18–20

Thus, the research and development work of the ATOS team culminated in ATOS for Books, a readability formula based on both test-item data and actual book reading experiences, that is specifically suited for use with trade books. The development team also paid special attention to areas where educators have reported dissatisfaction with existing readability formulas: nonfiction books, emergent reader books, high-low books for older readers, and books leveled for use with Reading Recovery, where the connection between conventional readability and the Reading Recovery system has always been unclear. Solutions were found in each of these areas as explained above. Finally, ATOS also eliminates sampling error by using high-speed scanners to analyze entire texts. ATOS levels reflect the entire book, not just sampled passages.

ATOS for Books Grade-Level Scales

ATOS for Books expresses readability with a grade-level scale that minimizes overall adjustments from the Flesch-Kincaid scale previously used in Accelerated Reader. For most books there will be some change in the readability levels from Flesch-Kincaid to ATOS and also some change in point values. Although certain types of books change more than others, on average, across the entire range of books in the AR quiz collection, readability was virtually unchanged.

The grade-level scale is easy to understand, and allows teachers to use common grade-level measurements, such as grade equivalents from standardized tests, when matching student reading ability to book levels. Formulas that use non-grade-level scales, such as Lexile, are hard to compare and understand, and make more work for teachers and parents.

In keeping with the concept of open standards, School Renaissance Institute also developed a conversion of ATOS for Books to a 100 point scale like the one used by DRP and a 2000 point like the one used by Lexile. The table below shows ATOS levels and the corresponding 100 point scale and 2000 point scale values.

ATOS to 100 Point and 2000 Point Scales Conversion Chart

ATOS Levels	100-Point Scale Values	2000-Point Scale Values
0.5	27	70
1.0	35	170
2.0	42	370
3.0	46	508
4.0	49	646
5.0	52	784
6.0	55	922
7.0	59	1060
8.0	62	1198
9.0	63	1336
10.0	65	1475
11.0	66	1613
12.0	68	1751
13.0	69	1888
14.0	70	2026
15.0	71	2165

Adjustment of ATOS for Special Cases

A panel of experts periodically reviews the reading levels provided by ATOS for reasonableness. Renaissance Learning continues to make adjustments based on standardized rubrics for certain books where it is obvious that the readability formula is not fully accounting for text difficulty. We do this for many of the classics, including books by English or foreign authors, poems, plays, and early American literature.

Advantages of ATOS for Books

ATOS improves readability scoring of several types of books where previous formulas have been less accurate and less helpful to teachers. Because ATOS provides higher readability scores for longer books, it intrinsically encourages students to choose longer books because the Accelerated Reader point values are now higher, reflecting the fact that their length makes them more difficult to read. ATOS also takes into account the differences between fiction and nonfiction. It more accurately levels low-level books, whether they are aimed at high-low or emergent readers. The result of all these improvements is less guesswork by both teacher and student. Better matching of books to students with ATOS will help teachers keep students in their appropriate reading range (zone of proximal development), and thereby accelerate growth in student reading ability and learning.

Like any readability formula, however, ATOS must be interpreted and used with care. All readability formulas, including ATOS, measure only some, not all, of the variables that influence the difficulty of text (see the "Gettysburg Address" example, earlier). No formula is a substitute for a trained teacher or librarian who knows her students—rather, readability is a tool in the teacher's and librarian's hands.

ZPD Tables: Putting Text and Reader on the Same Scale

The first step in matching a reader to a book is to relate a student's tested reading level to the readability level of a book. An open system allows one to use any norm-referenced reading test for this purpose, while a closed system such as Lexile requires the use of a licensed test. School Renaissance Institute supports an open system and puts student and text on the same scale through use of a published ZPD table that relates a student's tested grade-level equivalent score to a readability range called the zone of proximal development. The ZPD conversion chart shown on next page is based on a study of over 80,000 students.

Grade Equivalent to ZPD Conversion Chart

Grade-Equivalent Score	ZPD (ATOS Book Level)	
	Average	Range
1.0	1.5	1.0–2.0
1.5	2.0	1.5–2.5
2.0	2.5	2.0–3.0
2.5	2.8	2.3–3.3
3.0	3.1	2.6–3.6
3.5	3.4	2.8–4.0
4.0	3.7	3.1–4.3
4.5	4.1	3.4–4.7
5.0	4.4	3.7–5.1
5.5	4.8	4.0–5.5
6.0	5.1	4.3–5.9
6.5	5.5	4.6–6.3
7.0	5.8	4.9–6.7
7.5	6.1	5.1–7.1
8.0	6.3	5.2–7.5
9.0	6.6	5.3–8.3
10.0	6.9	5.4–9.1
11.0	7.2	5.5–9.9
12.0	7.5	5.6–10.7

Again, however, this ZPD conversion chart is a guideline only, not a substitute for a teacher's professional judgement.

A Word of Caution: Readability Does Not Measure Appropriateness

Readability levels indicate reading difficulty, not appropriateness of material. Readability levels do not necessarily indicate that a book is suitable for particular students. In many cases, the readability level may be quite low though the material in the book is appropriate only for older or more mature students. This is true for many popular novel series, for example.

Renaissance Learning assigns book levels solely based on the reading difficulty of the text. Renaissance Learning does not and cannot censor books based on the maturity of the theme or issues such as language. Judgments about appropriateness vary depending on the region, school, maturity of individual students, parental wishes, and knowledge of book content. These decisions are up to the professional judgment of the school librarian, the teacher, and the student's parents.

To assist educators in their decisions, "interest levels" are provided in the AR BookGuide product, as well as on the Renaissance Learning web site, reflecting publisher judgment on approximate suitability levels. It is recommended, however, that educators also consult reviews and the book itself when making decisions about a book's suitability for any given student. Appropriateness is an inherently local issue. Renaissance Learning is a national company and cannot engage in censorship.

Conclusion

Matching students to books remains as much art as science, which is why teachers are—as they have always been—essential in the teaching of reading. No formula can take the place of a trained teacher who knows her students. However, readability formulas are important tools. They give teachers and librarians a beginning—a place to start in their task of matching a student to a book and, we hope, creating a student who loves to read. ATOS Readability Formula for Books, designed especially to accurately level trade books, is a superior tool for accomplishing this task.

Bibliography

Bormuth, J.R. *Development of Readability Analysis.* Chicago: The University of Chicago, 1969.

_____. *Development of Standards of Readability: Toward a Rational Criterion of Passage Performance.* Chicago: The University of Chicago, 1971.

Carroll, J.B., Davies, P., & Richman, B. *The American Heritage Intermediate Corpus.* New York: American Heritage Publishing Company, 1971.

Chall, J.S., Bissex, G.L., Conrad, S.S., & Harris-Sharples, S.H. *Qualitative Assessment of Text Difficulty—A Practical Guide for Teachers and Writers.* Cambridge: Brookline Books, 1996.

Chall, J.S., Conard, S.S., & Harris-Sharples, S.H. *Should Textbooks Challenge Students? The Case for Easier and Harder Books.* New York: Teachers College Press, 1991.

Chall, J.S. & Dale, E. *Readability Revisited—The New Dale-Chall Readability Formula.* Cambridge: Brookline Books, 1995.

Flesch, R.F. "A New Readability Yardstick." *Journal of Applied Psychology* 32 (1948): 221-233.

Fry, Edward. "A Readability Formula That Saves Time." *Journal of Reading* 11 (1968): 513-516.

Kincaid, J.P. *Derivation of New Readability Formulas (Automated Readability Index, Fog Count and Flesch Reading Ease Formula) for Navy Enlisted Personnel.* Springfield: National Technical Information Service, 1975.

Koslin, B.L., Zeno, S., & Koslin, S. *The DRP: An Effective Measure in Reading.* New York: College Entrance Examination Board, 1987.

School Renaissance Institute (formerly the Institute for Academic Excellence). *ZPD Guidelines: Helping Students Achieve Optimum Reading Growth.* Madison: School Renaissance Institute, Inc., 1999.

Stenner, A.J. *Measuring Reading Comprehension with the Lexile Framework.* Durham: MetaMetrics, Inc., 1996.

Stenner, A.J. & Burdick, D.S. *The Objective Measurement of Reading Comprehension in Response to Technical Questions Raised by the California Department of Education Technical Study Group.* Durham: MetaMetrics, Inc., 1997.

Vygotsky, L.S. *Thought and Language.* Cambridge: MIT Press, 1962.

Zeno, S.M., Ivens, S.H., Millard, R.T., & Duvvuri, R. *The Educator's Word Frequency Guide.* Brewster: Touchstone Applied Science Associates, Inc., 1995.

Reading Renaissance is a registered trademark of School Renaissance Institute, Inc. AR, ATOS, Reading Practice, and School Renaissance are trademarks of Advantage Learning Systems, Inc. Accelerated Reader, AR BookGuide, and STAR Reading are registered trademarks of Advantage Learning Systems, Inc.

Degrees of Reading Power, DRP, and TASA are registered trademarks of Touchstone Applied Science Associates, Inc. The Lexile Framework is a registered trademark of MetaMetrics, Inc. Reading Recovery is a registered trademark of the Reading Recovery Council of North America.

For more information, or for additional copies of this report, contact:

School Renaissance Institute

School Renaissance Institute • Educational Research Department
P.O. Box 45016 • Madison, WI 53744-5016
(800) 200-4848 • www.SchoolRenaissance.com

Developer of the School Renaissance Model: The Nation's Leading Comprehensive Academic Improvement Process

Renaissance Professional Development, Reading Renaissance, and Math Renaissance • School Renaissance Institute, formerly the Institute for Academic Excellence

Copyright © 2000 School Renaissance Institute, Inc. All rights reserved.

L0376.1000.RN.50M